A Cost-Efficient Approach to Inventory Management

Using IUID to Meet an Organization's Specific Requirements

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Members of the Department of Defense (DoD) acquisition workforce are very familiar with the "S-curve" that describes a weapon system's life-cycle costs; they also know that approximately 60 percent to 70 percent (or more) of a weapon system's life-cycle costs are typically associated with day-to-day operations and support (O&S) costs. In other words, O&S costs comprise more than half the total ownership cost (TOC) of most programs, and for this reason O&S costs have become the target of many proposed savings initiatives. One projected savings area within the O&S budget is "better inventory management." Inventory management is the focus of this article—in

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
FEB 2013		**00-00-2013 to 00-00-2013**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
A Cost-Efficient Approach to Inventory Management Using IUID to Meet an Organization's Specific Requirements	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Defense Acquisition University,Defense AT&L,9820 Belvoir Road,Fort Belvoir,VA,22060-5565**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**6**	

particular, the efforts of the Naval Surface Warfare Center (NSWC) Explosive Ordnance Disposal Technology Division (EODTECHDIV), Indian Head, Md.

EODTECHDIV is one organization that has made serious strides to tackle the issue of inventory management and rising O&S costs by exploiting technology—namely, item unique identification (IUID) and radio frequency identification (RFID).

EODTECHDIV, as one of DoD's premier organizations responsible for Explosive Ordnance Disposal (EOD) mission-related requirements, is at the forefront of U.S. efforts to counter improvised explosive devices (IEDs). The organization is responsible for the repair, inventory control, and shipment of numerous EOD robots designed to support the warfighter's stand-off capability to counter the IED threat. As a result of the Iraq and Afghanistan wars, demand for counter-IED robotic capabilities has grown significantly. In addition, due to its outstanding reputation in the industry, EODTECHDIV increasingly became a focal point for the other Services to seek out robotic counter-IED support.

Background

The DoD never has experienced a shortage of honest and well-meaning attempts by individuals and integrated product teams to find better and more cost-effective approaches to weapons system acquisition and services acquisition. Truly motivated and analytical minds, in a continual stream, have wrestled with how to better enable the DoD acquisition process to develop and deliver products that meet the warfighter's performance requirements while remaining within cost and schedule requirements—and the EODTECHDIV is no different.

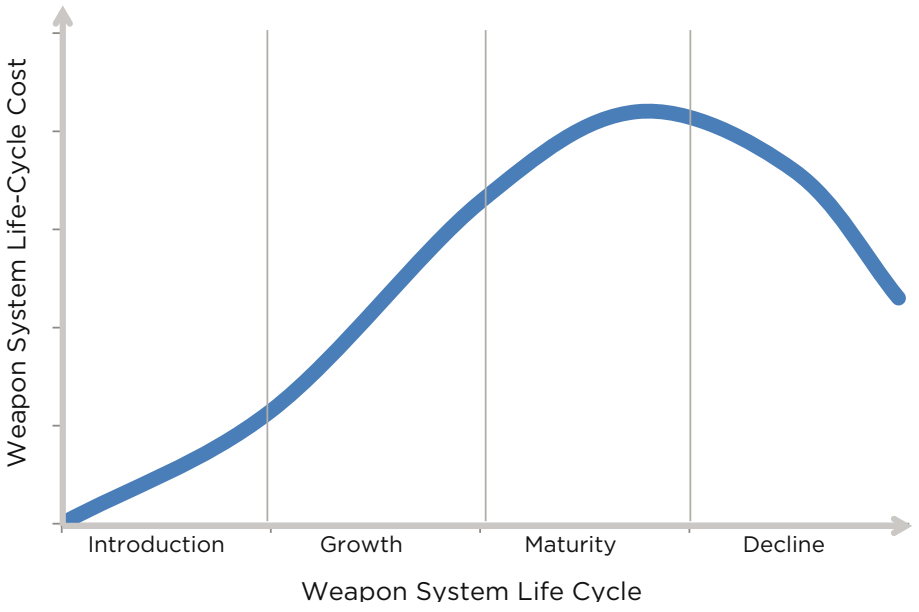
While DoD program managers have always focused on achieving cost-schedule-performance, the pressure to increase efficiencies in DoD acquisition programs has never been so impassioned. DoD no longer expects a "budget growth" business environment. As a means to satisfy such expectations for acquisition efficiencies, DoD launched a number of best business practices intended to ensure the Department's ability to "do more without more." Assembled under the mantle of "Better Buying Power" are principal actions forming a foundation of proven lessons-learned, whereby DoD program managers are expected to use their creativity and innovation to identify program efficiencies.

When outlining budget priorities and choices for Fiscal Years 2013 through 2017, DoD calls for a "more disciplined use of defense dollars" by reducing excess overhead, operations expenses, and personnel costs across the enterprise as well as achieving Better Buying Power in the acquisition of systems and services. Through using improved business practices across the enterprise, DoD has tentatively targeted several areas to achieve approximately $60 billion in new projected savings over FY 2013 through FY 2017. EODTECHDIV is a prime example of how an organization can capitalize on one of these particular areas—inventory management.

Current DoD documentation reflects the increased focus on O&S cost and specifically inventory management. The Office of the Secretary of Defense's *Operating and Support Cost-Estimating Guide* (https://acc.dau.mil/CommunityBrowser.aspx?id=187960), dated October 2007, takes inventory control into account. In addition, the DoD Logistics Strategic Plan identifies a number of business process initiatives to realize effective, efficient, and secure supply chain management operations (http://www.acq.osd.mil/log/sci/DoDLogStratPlanFinalSigned-100707.pdf). One of the business process initiatives called out in response to FY 2010 National Defense Authorization Act direction is inventory management. *The Product Support Manager Guidebook* (https://acc.dau.mil/psm-guidebook), dated April 2011, also addresses key requirements to manage product support across the entire life cycle of a weapon system, and one of the 12 integrated product support elements is supply support, which includes inventory management.

In the private sector, where maximizing the bottom line is of utmost importance, inventory management has been a constant focus. Historically, inventory management has been a manpower-intensive undertaking with the potential of prob-

Figure 1. Life Cycle Cost Diagram



Inventory management technology has evolved from manually tracking the movement of materials in and out of the stockrooms to one of reliance upon a sophisticated integration of hardware and software specifically built to provide real-time inventory management that uses minimal manpower.

lematic results, such as "lost" inventory. This problem only escalates as industry grows and inventory size increases. From a business perspective, such lost inventory equates to increased costs (i.e., resources to track down or replace if the item is not located) and late customer deliveries. For the private sector, inventory management technology has evolved from manually tracking the movement of materials in and out of the stockrooms to one of reliance upon a sophisticated integration of hardware and software specifically built to provide real-time inventory management that uses minimal manpower.

Item Unique Identification

One answer to the problem of inventory management is IUID, an identification system created by DoD that enables tangible items to be identified from one another. IUID requires four steps: (1) Mark Items; (2) Scan the Mark; (3) Update Automated Information Systems; (4) Reengineer Business Processes to Use the Mark.

1. Mark Items

IUID includes the process of assigning a unique identifier to qualifying personal property items in the DoD inventory and physically marking the items with a two-dimensional (2-D) data matrix mark that contains a unique item identifier (UII). Personal property includes material systems, equipment, materials, and supplies. (See DoDI 8320.04 and DoDI 5000.64.) The UII is a unique data string assigned to a single item and is never reused. All UIIs are to be registered in the DoD IUID Registry once assigned to an item and upon government acceptance. Think of how U.S. citizens receive their unique Social Security number that follows them forever and is never reissued to a different individual. UIIs are associated with an item via a 2-D data matrix. This 2-D data matrix is a machine-readable representation of the UII. The data matrix then is permanently affixed to any item deemed worthy of being tracked. An item meeting any of the following criteria should be tracked via IUID:

- All items that cost more than $5,000
- All items that are serially managed
- All items that are deemed mission essential
- All items that are considered controlled inventory

2. Scan the Mark

Once an item is marked, the 2-D mark can be scanned with an Automatic Identification Technology (AIT) device.

3. Update Automated information Systems

The scanning process allows the item to be linked to its data within an automated information system (AIS)—once the AIS has been modified to support IUID. As information flows from AIS to AIS, this allows the UII to associate data about the item throughout the item's life cycle for improved product life cycle management, property accountability and management, financial transparency, and valuation.

4. Reengineer Business Processes to Use the Mark

Programs engage in business process reengineering (BPR) to make use of the new data availability, item traceability, and inventory management.

From a DoD perspective, the IUID implementing policy is DoD Instruction 8320.04, *Item Unique Identification (IUID) Standards for Tangible Personal Property*, dated June 16, 2008 (http://www.dtic.mil/whs/directives/corres/pdf/832004p.pdf). The Services then augment this instruction with implementing policies of their own; in the case of the Department of the Navy, such a Service-specific implementing policy is Secretary of the Navy Instruction (SECNAVINST) 4440.34, *Implementation of Item Unique Identification within the Department of the Navy*, dated Dec. 22, 2009 (http://doni.daps.dla.mil/Directives/04000%20Logistical%20Support%20and%20Services/04-400%20Supply%20and%20Material%20Services/4440.34.pdf).

NSWC EODTECHDIV Story

Naval Surface Warfare Center (NSWC) EODTECHDIV is a field activity that reports to the Naval Sea Systems Command as a division of the NSWCs. It is a unique support activity administered by the U.S. Navy working together with all of the Services to determine and address joint service EOD requirements.

In 2005, the Man Transportable Robotics System (MTRS) Abbreviated Acquisition Program (AAP) was elevated to an Acquisition Category (ACAT)-IV program because of the increased requirement of systems due to the increased IED threat in Operation Iraqi Freedom and Operation Enduring Freedom. As an ACAT-IV program, one of the key requirements was an independent logistics assessment (ILA). One of the findings from this ILA was that there was no plan or

contract for IUID for the MTRS. The MTRS consists of two different platforms by two different manufacturers. During the same timeframe, the logistics manager began looking into a Supply Chain Management (SCM) system that would be flexible enough to manage the MTRS in both theaters and other venues. The system would track shipping and receiving, track assets (i.e., total asset visibility), manage configuration changes, track maintenance actions, and allow government and the original equipment manufacturers (OEM) access to the data. This led to a specific commercial-off-the-shelf database tool called Catalog Ordering Logistics Tracking System (COLTS).

Mark Items

In the meantime, the MTRS Contracting Officer had the MTRS OEMs provide the EODTECHDIV with a cost to implement IUID for their respective platforms, which resulted in only one OEM being given the task of providing IUID-marked items. To include IUID requirements, the second OEM wanted $250,000 for nonrecurring engineering, another $4,000 annually for recurring engineering, plus $80 per label. This was unacceptable, so EODTECHDIV researched and gained the capability to produce IUID labels itself. As a result, the EODTECHDIV team was able to produce all the labels for their legacy systems and have their parts marked prior to a DoD December 2010 deadline, at a cost of about $1.50 per label. Thus EODTECHDIV has addressed the first element of IUID—mark items.

Scan the Mark

EODTECHDIV's marked parts (2-D matrix) are read with a scanner upon introduction to its warehouse and when parts exit the warehouse. The information is fed into the SCM database and, along with other data linked via IUID, provides data points needed to support metrics such as Operational Availability, Mean Time Between Failures, Mean Logistics Delay Time, and failure trend analysis, and OEM depot performance (including price to repair). EODTECHDIV has addressed the second element of IUID—scan the mark.

Update Automated Information Systems

To address the third element of IUID—update the automated information systems—EODTECHDIV worked with the vendor of COLTS to incorporate IUID into the database toolset. EODTECHDIV worked hard to create an environment where data are paramount and readily accessible. When the very first MTRS went on its first mission with an EOD Technician in Iraq and encountered the explosive end of an IED, the MTRS sustained damage and needed repair. From that very first failure and every subsequent failure over the next 7 years, the EODTECHDIV has data on cost to repair, parts to repair, and time to repair, and, because of IUID, it is all located in a single database application for all to see. The next logical step was to use IUID to gain efficiencies in inventory management.

Reengineer Business Processes to Use the Mark

The EODTECHDIV began an investigation into inventory process improvements to decrease the turnaround time between stocking inventory assets (such as systems, critical repair parts/components, etc.), and those same inventory assets being shipped to customers. To those familiar with "just-in-time" logistics, initiatives frequently are considered in efforts to decrease a systems logistics footprint and to minimize the Work in Progress (WIP) in the system and items on the shelf. If an organization can control these two factors, the result often is cost savings and customers receiving their assets quicker.

This process improvement investigation led EODTECHDIV to the realization it could improve on its method of tracking inventory. Part of the investigation was conducting two separate Lean Six Sigma events, where EODTECHDIV discovered it averaged 30,000 pounds of inventory movement per week, mostly in packages of 150 pounds or less. To conduct its annual inventory, EODTECHDIV had to literally shut down operations for an entire week. Despite the inventory manager's

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best efforts, these inventories had a 20 percent to 25 percent discrepancy rate of "lost" or "misplaced" items. With one robot arm valued at $43,000 and the potential for significant cost impact for lost or missing items, the current system obviously was not working. In addition, it took one full-time person more than 2 months to account for the discrepancies. EODTECHDIV tried replacing the annual inventory with a quarterly inventory in order to cut down on inventory discrepancies, but this did not result in an improvement. It actually meant that EODTECHDIV's warehouse was shut down for 4 weeks per year, which was not a viable option in the midst of an ever-increasing demand to support the warfighter.

Radio-Frequency Identification (RFID) and a Real Time Locating System (RTLS)

EODTECHDIV turned to technology in an attempt to solve some of its inventory management challenges. Specifically, EODTECHDIV decided to make an additional financial investment into radio-frequency identification (RFID) and a real time locating system (RTLS). RFID is a technology that transmits the identity of an object wirelessly and RTLS is a system that tracks the RFID tags. The fact that EODTECHDIV's items were marked via IUID allowed for an easier adaptation to the RFID system. Each RFID tag is assigned a number when the tag is activated. EODTECHDIV uses this tag number as a unique identification and associates the RFID number to the IUID information. Every IUID-marked part's shipping container is marked with an RFID tag. As long as the shipping container (with its RFID tag) is in the warehouse and its IUID-labeled part is in the container, the part is tracked via the RTLS. Once the part and its shipping container are sent out for repair, they are no longer tracked in the RTLS. Shipping containers are reused to send broken parts to the OEM for repair and to send ready-for-issue parts to the warehouse. When a shipping container is received at the warehouse with a different part than it left with, as is usually the case, the RFID tag on the case is removed and the part currently in the container is scanned via the IUID. A new RFID tag is printed and attached to the shipping container, completing the new association and letting the RTLS know the part has returned and is ready for processing and tracking.

RFID technology removes the need to physically scan the mark repeatedly in the warehouse because it does not require contact or direct line of sight for communication. The data held in the RFID tag can be read through the human body, clothing, and nonmetallic materials.

RFID technology is not new. In fact, RFID is in use in our everyday lives, for example: animal ID chips, the E-ZPass electronic toll-collection system, or the SpeedPass electronic gas-payment system. This technology relies on radio waves to transfer information from the RFID "tagged" item, to an electronic reader.

EODTECHDIV employed "passive" RFID (pRFID) tags that receive energy from the electronic reader itself, so there's no need to provide an external energy source (i.e., battery). The technology for pRFID also is able to instantaneously detect readings from numerous tags by the electronic reader while in a box, carton, case, etc. Finally, this technology is readily linked to commercial tracking systems such as Federal Express in order to maintain 100 percent in-transit visibility.

To implement pRFID technology, EODTECHDIV used the RTLS. As with other pRFID-based architectures, the RTLS relies on a series of antennas that "cover" the warehouse footprint with an RF pulse every 7 seconds. The antenna pulses are combined by the RTLS software to provide a 24-hour/7-day-a-week picture regarding the location of every RF tag within the warehouse. The RTLS information is automatically fed into COLTS, the commercial off-the-shelf, Web-enabled capability used for supply chain management. EODTECHDIV uses COLTS to maintain a logistics "picture" of the on-hand inventory for all Programs of Record. With the addition of RTLS and pRFID, instead of shutting down the warehouse to do an "all hands wall-to-wall inventory" EODTECHDIV has a complete inventory of the entire warehouse automatically once a day with no human intervention. The combined picture is displayed on a big-screen "status board" so EODTECHDIV can visualize individual or all RFID tags (i.e., robotic assets) to within 3 feet inside the warehouse. EODTECHDIV claims: "We can actually watch items moving in the warehouse. We watched one item being removed from the warehouse after normal work hours and followed it to another room in the building." The big status board also identifies any discrepancies from the daily inventory, allowing the warehouse manager to resolve them daily vs. quarterly or annually. This alone drastically reduces the "touch time" associated with reconciling inventory discrepancies. Instead of taking months of dedicated effort, inventory reconciliation is accomplished in a few minutes daily.

Use the Mark—Results

Because of the ability to incorporate the IUID elements to meet its organization-specific needs, EODTECHDIV was able to maintain 100 percent supply accuracy for forward deployed units. "We actually monitor the number of items at each site and adjust as necessary to keep no more than a 7-day supply of parts on the shelf. A couple of times in the past 2 years we have adjusted the supply and got inquiries from the receiving end as to why we increased their stock. We noticed they needed the parts before they did." When compared to the previous manually intensive approach to inventory management, the use of an IUID-enabled process (modified via technology to meet specific organizational requirements) was found to significantly increase the chances of 100 percent accountability for all assets identified within the inventory. This "shrinkage avoidance" resulted in less inventory lost or misplaced, which translated to lower costs either through avoiding use of manpower to find lost/misplaced assets and/or the need to reorder replacements of ensure inventory maintenance at prescribed levels. EODTECHDIV reports: "Because of our aggressive failure identification program and resolutions, I now have over 2 months additional spare parts on my shelves with a corresponding increase in probability of a spare on the shelf of 99 percent, with no additional funding required from the Services. In addition, I have reduced the 12.5 percent sparing requirement to about 4 percent on all current and future orders."

Prescribed levels of inventory assets are able to be maintained by the RTLS, providing a picture of the EODTECHDIV warehouse to the COLTS AIS. With an initial goal of 90 percent in-theater operational availability for robotic IED assets, EODTECHDIV was able to achieve a greater than 95 percent in-theater operational availability through the implementation of IUID utilizing pRFID, RTLS, and COLTS to meet the specific needs of its organization. According to EODTECHDIV, "This integrated effort enabled better maintenance, supply, transportation, and acquisition decisions that increased production throughput and system operational availability, and decreased carry inventory and operating costs over the last 7 years."

EODTECHDIV's implementation of the IUID process of associating the item and the data about the item to the inventory management of robotic assets has enabled numerous value-added benefits.

- More accurate supply-chain management and operations costs based on actual data collected by the RTLS, which provides a cumulative "tracking" of life-cycle costs associated with robotic repairs and upgrades resulting in an increased mission performance capability to the warfighter.
- 100 percent inventory control on all IUID RF-tagged assets every 7 seconds, 24 hours per day.
- EODTECHDIV ability to submit budgetary requirements for its 6-year future years defense plan submittal based on actual data collected through its IUID-enabled processes.

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- EODTECHDIV ability to make more precise customer funding requests based on cumulative tracking of actual life-cycle costs.
- Improved configuration management and asset visibility.
- Assistance to establish a Condition Based Maintenance Plus environment.
- Support of the next-generation "sense and respond" maintenance paradigm, which allows the supply chain to predict future demands and respond accordingly.
- Monitoring and better management of the financial transactions associated with more than 100 customer "checkbooks" (i.e., Is there enough money in the account?) used by all four Services.
- Improved quality assurance for inspections, reports, and repairs.
- Savings of approximately 1 full man year of labor using automatic vs. manual inventory methods.
- Improved data accuracy and speed of processing receipts and issues.

Ultimately, DoD continually seeks more cost-effective approaches across all programs to decrease total ownership costs. With an impact that resonates to upward of 70 percent of a program's total costs, logistics is "at the pointy end of the spear" in identifying cost efficiencies that allow the Department to "do more without more." One success story within the context of inventory management is EODTECHDIV's creativity and innovation in identifying program efficiencies by adapting the four elements of IUID: (1) EODTECHDIV identified a cost-effective method to ensure its parts are marked with IUID; (2) EODTECHDIV's marked parts (2-D matrix) are read with a scanner upon introduction to their warehouse; (3) EODTECHDIV modified its automated information systems to use IUID; and (4) EODTECHDIV reengineered its business processes to use the IUID mark and then layered RFID on top to better manage the warfighter's high demand for robotic assets.

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